PEMANFAATAN LIMBAH CAIR TEMPE DALAM MEDIA AIR BUDIDAYA UNTUK PERTUMBUHAN DAN EFISIENSI IKAN NILA *(Oreochromis niloticus)*

NASKAH PUBLIKASI

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201610260311031

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KATA PENGANTAR

Puji syukur penulis panjatkan kehadirat Allah SWT yang telah melimpahkan hahmat dan hidayahNya sehingga penulis dapat menyelesaikan skripsi dengan judul **Pemanfaatan Limbah Cair Tempe dalam Media Air Budidaya untuk Pertumbuhan dan Efisiensi Pakan Ikan Nila *(Oreochromis niloticus)*** sebagai salah satu syarat untuk memperoleh gelar sarjana perikanan di Universitas Muhammadiyah Malang.

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Malang, 18 September 2020

Penulis

Heryanto

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Utilization of Tempeh Liquid Waste in Cultural Water Media for Growth and Feed Utilization Efficiency on Nile tilapia (*Oreochromis niloticus*)

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ABSTRACT. Tempeh waste has many nutrients including protein, fat, carbohydrates, Nitrogen Phosphorus, potassium and also has positive microbes which, if processed, can be used as utilization in fish farming. The purpose of this study is to determine whether the liquid waste media in tempeh waste can be utilized in the growth of tilapia (Orechromis nilaticus) and can make efficient use of feed. Test animals used were as many as 120 tilapia fish 5-8 cm. Tempeh waste used is liquid tempe waste that is the result of boiling soybeans. This research method uses a Completely Randomized Design (CRD) with treatment P0 (without liquid tempeh waste) P1 (5% waste dose) P2 (10% waste dose) and P3 (15% waste dose) by dissolving the dose into the fish culture media.1.42 ± 0.22), GR (8.61 ± 1.45) and absolute length (1.82 ± 0.38) The best EPP is P2 treatment (12.92± 6.77) and the lowest is P0 (4.77 ± 3.05). Tempeh liquid waste in the media of tilapia (Oreochromi nilatucus) significantly influences ($P < 0.05$) on absolute growth but does not significantly affect the specific daily weight gain and absolute length as well as on feed efficiency

Keywords: Tempeh Liquid Waste, Growth, Efficiency of Feed Utilization, Ammonia.

INTRODUCTION. Tempeh industry is a business that is able to influence the economic movement of the community. The existence of the tempe industry is not only in the environment of big cities but also in small cities. In Indonesia, there are currently around 81 thousand tempe industries that produce 2.4 million tons of tempe per year (BSN, 2012). The presence of tempeh industry in addition to having a positive impact also has a negative impact, namely the presence of waste that is not easy to process. The process of producing tempe produces solid and liquid waste. Liquid waste in processed tempe comes fromsoaking water, boiling, washing and stripping. The handling of wastewater produced cannot currently be utilized by the community and the resulting liquid waste is discharged into sewers and rivers, in contrast to solid waste, solid waste can be used as animal feed such as cattle and goats. Liquid waste discharged in the river can be polluted this because the nature of the liquid waste produced from tempe has an odor other than that algae blooms can occur in the waters due to organic compounds.

The compounds contained in tempe consist of 0.42% protein, fat 0.13%, carbohydrate 0.11%, water 98.87%, calcium 13.60 ppm, phosphorus 1.74 ppm and iron 4.55 ppm. If used appropriately, it will reduce environmental pollution

and eliminate the source of disease (Said, 1999). The contents in tempe liquid waste include nitrogen gas (N^2), oxygen (O^2), hydrogen sulfide (H^2S), Ammonia (NH^3), carbon dioxide (CO^2), and methane (CH^4) (Said 1999). In addition to the content of organic matter contained in tempe waste there are also bacteria. In the research "Isolation and Characterization of Lactic Acid Bacteria from Soybean Soaking Liquid Waste" obtained eight isolates that were successfully isolated from soybean soaking liquid waste, seven of which were identified as Lactic Acid Bacteria (LAB) which were suspected as members of the genus Lactobacillus (Amaliah *et al*. 2018) .

Lactic Acid Bacteria (LAB) is a type of gram-positive bacteria that has a role as a probiotic there are various beneficial microorganisms, namely Lactobacillus which is useful for fermenting organic material into lactic acid compounds, photosyntetic bacteria that function to absorb toxic gases and heat from the fermentation process, yeast which has a role in fermenting organic material into alcohol compounds, sugar and amino acids and Actinomycetes that function to produce antibiotic compounds that are toxic to pathogenic bacteria and able to dissolve phosphate ions and other micro ions (Wididana, 1993).

Tilapia is a fish that currently has a high economic value, and is a freshwater fish that is relatively easy to cultivate because it has a tolerant of the water is quite high. Besides tilapia has a high protein so that in addition to a good taste the nutritional value of tilapia will also provide a reason for people to consume tilapia, so high consumption of tilapia will increase market demand until now the development of tilapia production from year on year has increased in 2017 tilapia fish production reached 1.15 million tons, up by 3.6 percent from 2016 which reached 1.14 million tons (KKP 2017).

RESEARCH METHODS

Time and Place

This research was conducted on January 16 to February 16, 2020 which took place at the Fisheries Laboratory, Faculty of Agriculture-Animal Husbandry, Muhammadiyah University of Malang. East Java - Indonesia.

Material

The tools used in this study were 12 aquariums, analytical scales, rulers, ph meters, DO meters, thermometers, basins, nets, blowers, jerry cans, and aeration hoses. The materials used in this study are pellet feed, 5-6 cm tilapia fish, tempeh liquid waste and fresh water.

Methods

The method used in this study is a non factorial completely randomized design (RAL) experimental method. The type of factor tested was the difference in tempe liquid waste dosage consisting of four treatments and each consisting of 4 replications. The experimental unit is in the form of a 20x30x30 aquarium with 12 units with each aquarium filled with 25 liters of water and 10 fishes. The test treatments are as follows:

- Treatment P0: Tempeh liquid waste 0% per liter

- Treatment P1: Tempeh liquid waste 5% per liter
- Treatment P2: Tempeh liquid waste 10% per liter
- Treatment P3: Tempeh liquid waste 15% per liter

Procedures

Container Preparation

The container used in this study was an aquarium measuring 20x30x30 cm. The container used previously was washed first with water and sunlight then sterilized with a backlin to remove mold and bacteria. After that the aquarium is rinsed with clean water and then dried for 1 day, then each aquarium is filled with 25 liters of water and aerated.

Test Animals

Test animals used in this study were 5-8 cm tilapia obtained from the Pendem Fish Seed Center, Junrejo District, Batu City, East Java. The fish is put into a fiber bath for acclimation for 3 days.

Media preparation

The medium used is fresh water from the water pump of the fisheries lab and also as a test material, namely tempe liquid waste originating from the tempe industry in the village of Sanan, Malang. The tempe liquid waste is then mixed with the water of each aquarium and according to the concentration of the treatment. Then the media is allowed to stand for 3-7 days to reduce the level of wastewater saturation.

Test Parameters

Absolute Growth

Absolute growth or weight gain can be calculated using the formula (Dewantoro, 2001) as follows:

$$W = Wt - W0$$

Information :

W = Absolute weight growth (gr)
Wt = Weight of the final fish rearing (gr)
W0 = Weight of the initial fish in the study (gr)

Specific Growth Rate Daily or Specific Growth Rate

According to Agustin et al, (2014), the formula for calculating specific growth rates is:

$$SGR = \frac{InWt - InWo}{t} X100\%$$

Information :

SGR = Daily growth rate (%)
W0 = Average seed weight at the beginning of the study (gr)
Wt = Average weight of seeds on the t-day (gr)
t = Maintenance time (days)

Absolute Length Growth

Absolute length growth can be calculated using the formula (Effendi *et al.* 2006), namely:

$$L = Lt\text{-}L0$$

Information :

L. = Growth in absolute length (cm)

Lt = Final length (cm)

L0 = Initial length (cm)

Efficiency of Feed Utilization

The daily relative growth rate of fish is calculated using the NRC formula (1993) as follows:

$$EPP = \frac{Wt - W0}{F} 100\%$$

Information : EPP = Efficiency of feed utilization

F = Amount of feed (g)

Wt = Animal weight of the final test of the study (g)

Wo = Weight of the initial research animal (g)

Water quality

The quality of water observed in this study includes the level of water acidity (pH), temperature, Dissolved oxygen (D0) and ammonia. Data collection related to water quality is carried out routinely, once a week.

Data Collection Techniques

Sampling of data is done randomly *(Random sampling).*

To find out the growth of fish, 50 percent of the fish stocking population was tested for fish. Sampling of fish is done regularly, that is, once a week.

RESULTS AND DISCUSSION

Growth in absolute weights, Specific length and daily growth

The results of the analysis showed that the highest absolute weight growth was at a concentration of 5% per liter (P1) of 8.61 grams while the lowest absolute weight value was at 0% per liter (P0) of 3.42 grams. The absolute length increase of the research is highest in the P1 1.82 treatment and the lowest in the P0 1.22 treatment. The highest daily weight gain in tilapia during the study was in the treatment P1 of 1.5 g and the lowest in the treatment of P0 was 0.73. Data on absolute weight growth, daily growth rate and absolute length during maintenance can be presented in Table 1.

Table.1 Absolute weight (GR), Specific daily growth (SGR) and Absolute length.

Parameter	P0 (0% / liter)	P1 (5% / liter)	P2 (10% / liter)	P3 (15% / liter)
Absolute Weight (W)	3.42 ± 2.06	8.61 ± 1.45	5.70 ± 1.12	4.48 ± 0.68
SGR (% / day)	0.73 ± 0.45	1.5 ± 0.23	1.26 ± 0.26	1.21 ± 0.25
Absolute Length (cm)	1.22 ± 0.34	1.82 ± 0.38	1.54 ± 0.30	1.67 ± 0.34

The results of the analysis carried out using diversity (ANNAVA) F count > F table 1% and 5% so that it can be said the absolute growth value is significantly different. The results of the LSD P0 test were significantly different from P1 and were not significantly different from P2 and P3. P1 is significantly different from P0, P2 and P3. P2 is not significantly different from P0 and P3 but significantly different from P1. P3 is not significantly different in PO and P2 but ssignificantly different in P1. However, for absolute length and growth of specific weights from the results of diversity (ANNAVA) F count <F table 1% and 5% so that it can be said not significantly different. From the absolute growth value data table the highest value is in the treatment of tempe liquid waste 5% per liter (P1) and the lowest is P0 or no treatment. Likewise with the absolute length and the highest daily weight gain is the treatment P1 and the lowest is P0.

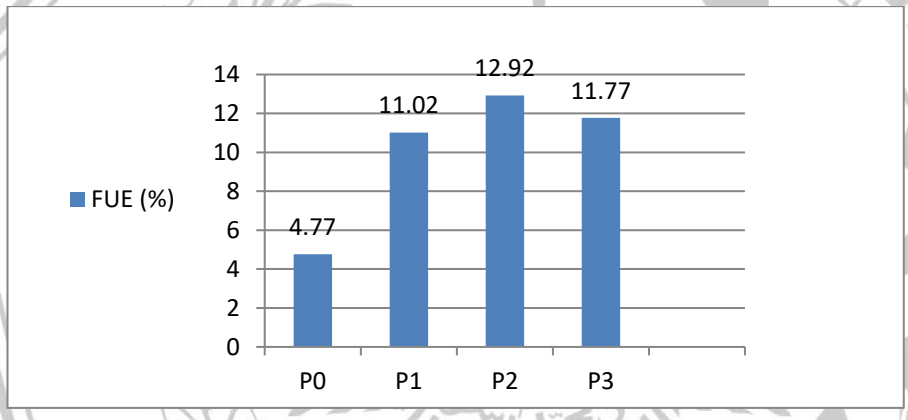
The difference in length and weight that is not the same has a significant effect on this because the growth of fish weight is faster than the increase in length, same with the opinion of Islaminingrum (2011) in Mashuri *et al*., (2012) that the relationship between length and weight that occurs in fish, is that positive allometric which shows that the growth of fish weight is faster than the growth in length and negative allometric which shows that the growth of fish length is faster than the growth in weight.This difference in growth value is caused because liquid waste from tempe contains organic material such as N, P and K, besides that in tempe waste there are positive bacteria that are bacteria that can benefit orgasm. Nurosid, (2011) states that the largest component of tempe liquid waste is protein (N-total) of 226.06 mg / L to 434.78 mg / L, so that the entry of tempe liquid waste into the aquatic environment will increase the total nitrogen in these waters. MZ (2015) states that organic material that enters the waters will be decomposed into nutrients, for example nitrogen (N) and phosphorus (P). Andersen *et al*. (2006) stated that an increase in nutrients in water, especially N and P, can trigger the growth of phytoplankton and aquatic plants which can affect the structure, function and balance of the ecosystem. The concentration of these nutrients will be able to make the waters fertile, with fertile waters, the availability of nutrients for fish will be fulfilled so that growth will be good.

The types of bacteria found in tempe liquid waste are Lactic Acid Bacteria (LAB). In the research of Amaliah et al (2013) regarding the isolation and characterization of Lactic Acid Bacteria from Soybean Tempe Wastewater, eight isolates were isolated, seven of which were identified as lactic acid bacteria belonging to the genus Lactobaacillus. Sulistijowati (2016) states that lactic acid bacteria are gram-positive and false-negative bacteria that produce lactic acid in carbohydrate fermentation, and are normal flora found in the digestive tract of animals, both land and aquatic animals. Wulandari (2017) said that lactic acid bacteria have an important role in fish life, because naturally these bacteria are able to boost the immune system and help the digestive organs in digestion. Lactic

acid bacteria tend to be able to increase specific and nonspecific immune systems, such as lysozyme activity in the body, macrophages, and respiratory bursts. Lactic Acid Bacteria enter the digestive tract of fish and live in it. Bacteria in digestion then secrete digestive enzymes such as protease and amylase enzymes (Irianto, 2003). Gatescoupe (1999) states that the enzyme can function as a catalyst in the digestion of carbohydrates and proteins. In addition, the function of LAB plays an important role in breaking down organic matter in a waters so that it can improve water quality in a media. Hadioetomo, (1993) a group of lactic acid bacteria that is in a digestion will act as a probiotic and if it is present in an aquatic environment it acts as a decomposer

Feed Utilization Efficiency

The results of the study of the addition of tempe liquid waste to the efficiency of tilapia fish utilization can be seen in figure 1.
Graphic Figure 1. Efficiency of Tilapia Feed Utilization during the study (%).



The results of the analysis carried out using diversity (ANNAVA) F count <F table 1% and 5% so that it can be said the efficiency of feed utilization is not significantly different. Even though the treatment was not significantly different, the lowest value of the utilization of feed was in the treatment P0 (0%) compared to other treatments the Feed Utilization Efficiency value was 4.77 ±. Feed Utilization Efficiency is the most important factor in supporting fish growth. Feed quality, amount of feed and water quality greatly affect the growth of fish weights. The low value of treatment P0 (0%) is due to the alleged lack of nutrients in the media and the absence of gram-positive microbial bacteria that can help the digestive process. Statement by Widanarni *et al*. (2009) that feed efficiency in the treatment with the application of biofloc technology is higher because of an increase in biofloc biomass as a source of nutrition or supplementary food for cultivation cultivation. The abundance of microbes in aquaculture media is also expected to play an active role in the digestive process such as the application of probiotics in fish feed. From the results of the study of Ahmadi *et al*. (2012) giving probiotics at a dose of 108 cells / ml only gave an efficient value of feed utilization of 43.93%. The high value of the efficiency of the use of feed given tempe liquid waste in tilapia culture media shows a better value compared to the

treatment without tempe wastewater treatment. The abundance of microbes in aquaculture media is also expected to play an active role in the digestive process such as the application of probiotics in fish feed. From the results of the study of Ahmadi *et al*. (2012) giving probiotics at a dose of 108 cells / mL only gave an efficient value of feed utilization of 43.93%. The high value of the efficiency of the use of feed given tempe liquid waste in tilapia culture media shows a better value compared to the treatment without tempe wastewater treatment. The abundance of microbes in aquaculture media is also expected to play an active role in the digestive process such as the application of probiotics in fish feed. From the results of the study of Ahmadi *et al*. (2012) giving probiotics at a dose of 108 cells / mL only gave an efficient value of feed utilization of 43.93%. The high value of the efficiency of the use of feed given tempe liquid waste in tilapia culture media shows a better value compared to the treatment without tempeh wastewater treatment.

Water quality

Data on water quality results during the study can be presented in table 2.

Table 2. Water Quality During the Study

No	Treatment	Water Quality Parameters			
		Temperature	pH	DO (mg / l)	Ammonia The beginning
1	P0	25-29	6.5-8.8	2.0-2.9	0.0-1,5
2	P1	25-29	6,9-8,7	2.1-4.0	0.5-0.25
3	P2	25-29	7,1-8,6	2.2-3.3	1.5-0.25
4	P3	25-29	7,3-8,6	2.2-3.1	3.0-0.25

The degree of acidity obtained during the study of all treatments ranged from 6.5 to 8.8. From the ph data obtained it can be seen that the pH of all treatments is still in a condition that can be tolerated by tilapia, according to the statement Effendie (2003) which states that the optimal pH range for tilapia aquaculture is 6-8.5. Also in accordance with SNI 7550: 2009 the optimal pH for tilapia aquaculture is 6.5 - 8.5.

Temperature is a very important factor in fish farming, temperature can affect the body's metabolic rate in fish. The temperature range during the study for all treatments was around 25-29 ˚C according to the statement of Effendi et al. (2015) which states that the optimum temperature conditions for fish growth are 25-32 ˚C. This is also in accordance with SNI 7550: 2009 the optimal temperature for fish growth is 25-32 ˚C.

Dissolved oxygen is a very important factor in the cultivation of tilapia. Dissolved oxygen during the study from all treatments during the study 2.0 - 4.0 mg / l. Dissolved oxygen in all treatments during the study was still within the tolerance limits for tilapia, according to the statement(Popma and Masser, 1999) that tilapia can survive in the dissolved oxygen (DO) range of more than 0.3 mg / l. The value of dissolved oxygen for tilapia culture according to SNI 7550: 2009 states that the standard value of optimum levels of dissolved oxygen for the growth of tilapia is more than 3 mg / l.

Ammonia value in a fish culture container is very influential on the growth and survival of tilapia. Ammonia value at the beginning of the study was highest at P3 treatment and the lowest value at P0 treatment. Ammonia value at the end of the research was highest in the P0 treatment while the ammonia value of the other treatments was the same at 0.25 mg / l. The high value of ammonia at the beginning of the study was due to the high value of ammonia in tempe wastewater. The high value of ammonia is caused by the lack of ammonia content in the tempe waste by decomposing bacteria. As Harahap (2013) said, the ammonia in tempe wastewater will be broken down by bacteria (aerob-anaerobes) such as *Lactobacillus, Bifidobaterium, Clostridium, Bacteroides* and *Streptococcus bacteria*. According to Crab (2010).

cONCLUSIONS AND RECOMMENDATIONS

Conclusion

The conclusion that can be drawn from the research is the provision of tempeh liquid waste in the media of tilapia (Oreochromi nilatucus) significantly influences ($P < 0.05$) on absolute growth but does not significantly affect the specific daily weight gain and absolute length as well as on feed efficiency.

Suggestion

In order to give maximum results, it is expected that there will be a researcher who is interested in continuing this research to find out whether or not the application of tempe liquid waste is true.

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